

REMARKS

Summary

Claims 1 and 24 are currently amended. No new matter was added as a result. Claims 1-27 are currently pending.

Objections

The Examiner objected to the disclosure because paragraph [0006] included a typographical error. (Office Action, page 2). The specification has been amended to correct the error, as shown above. No new matter was added as a result.

35 U.S.C. § 102(b)

Claims 1-2 and 4-5 were rejected pursuant to 35 U.S.C. § 102(b) as being anticipated by Strozeski, et al. (U.S. Patent No. 5,146,050).

Independent claim 1 recites, *inter alia*, "transducer material having an array of elements." Strozeski, et al. discloses a transducer disc 150. (Strozeski, et al., column 6, lines 22-25). However, there is no teaching of transducer material having an array of elements. Accordingly, claim 1 is allowable over Strozeski, et al. Claims 1-9 and 27 depend, directly or indirectly, from currently amended and allowable claim 1 and, therefore, are allowable for at least this reason.

Further limitations distinguish from Strozeski, et al., resulting in these claims being allowable. Claim 2 recites, *inter alia*, a capacitive membrane, but there is no teaching of a capacitive membrane in Strozeski, et al.

Claims 1, 3, 5-7, and 27 were rejected pursuant to 35 U.S.C. § 102(b) as being anticipated by Miller, et al. (U.S. Patent No. 5,267,221).

In regards to claim 1, the Examiner argues that all the features are taught by Miller, et al. by pointing to column 6, lines 11-69. (Office Action, pages 2-3). However, column 6, lines 11-69 of Miller, et al. do not teach a backing block that includes an anechoic surface. Miller, et al. discloses electrical conductors 39 that are

thick enough to couple acoustic energy, and a block 37 having certain acoustic properties is used to create an impedance match between the wires 39 and the block 37 to facilitate flow of acoustic energy from the wires 39 into the block 37. (Miller, et al., column 6, lines 37-62). However, there is no teaching or mention of an anechoic surface included in a backing block. Accordingly, claim 1 is allowable over Miller, et al. Claims 1-9 and 27 depend, directly or indirectly, from currently amended and allowable claim 1 and, therefore, are allowable for at least this reason.

Further limitations distinguish from Miller, et al., resulting in these claims being allowable. Claim 5 recites, *inter alia*, that "the backing block comprises first and second different materials, the anechoic surface being at an interface of the first material with the second material." Fig. 5 of Miller, et al. discloses two material layers 37a and 37b of the block 37, and column 8, lines 22-27 of Miller, et al. disclose the use of one or more matching layers between 37a and 37b to minimize reflections at the layer junction. However, matching layers are not the same as an anechoic surface. There is no teaching of an anechoic surface, let alone an anechoic surface between different materials of a backing block. Claim 6 recites, *inter alia*, "the first material having an acoustic impedance within 10% of an acoustic impedance of the transducer material, the second material having an acoustic impedance at least 30% less than the acoustic impedance of the transducer material." Miller, et al. discloses that the upper layer 37a can have an acoustic impedance that substantially matches the transducer elements 13, and the portion (lower layer) 37b might have an acoustic impedance that substantially matches the acoustic impedance of the wires 39. (Miller, et al., column 7, lines 61-64 and column 8, lines 3-7). There is no teaching of a second material having an acoustic impedance at least 30% less than the acoustic impedance of the transducer material.

Claims 1, 4-5, 7-8, and 24-25 were rejected pursuant to 35 U.S.C. § 102(b) as being anticipated by Bar-Cohen (U.S. Patent No. 4,698,541).

Independent claims 1 and 24 recite, *inter alia*, "transducer material having an array of elements." Bar-Cohen discloses a piezoelectric crystal 12. (Bar-Cohen,

column 2, lines 15-17). However, there is no teaching of transducer material having an array of elements. Accordingly, claim 1 and 24 are allowable over Bar-Cohen. Claims 1-9 and 27 and claims 25-26 depend, directly or indirectly, from currently amended and allowable claims 1 and 24, respectively, and, therefore, are allowable for at least this reason.

Further limitations distinguish from Bar-Cohen, resulting in these claims being allowable. Claims 4 and 24 recite, *inter alia*, a Rayleigh dump surface. Figure 1 and claim 3 of Bar-Cohen disclose a roughened surface to induce wave scattering, but there is no specific teaching of a Rayleigh dump.

35 U.S.C. § 103(a)

Claims 2, 21-23, and 26 were rejected pursuant to 35 U.S.C. § 103(a) as being unpatentable over Bar-Cohen in view of Friemel, et al. (U.S. Patent No. 6,537,220) or Robinson (U.S. Patent No. 6,659,954).

Independent claim 21 recites, *inter alia*, "a silicon substrate supporting a plurality of flexible membranes; a backing block adjacent the silicon substrate." The Examiner argues that it would have been obvious to use the backing layers of Bar-Cohen with CMUT type devices of Friemel, et al. or Robinson. (Office Action, page 4). However, Robinson discloses the concept of a backing block when discussing a piezoelectric transducer array in the background section. (Robinson, column 1, lines 35-37). There is no teaching of using a backing block with the MUT's discussed in Robinson. Also, column 7, lines 18-19 of Friemel, et al. disclose a conventional backing layer 508 for a transducer array of PZT elements, not a MUT or CMUT. Friemel, et al. mentions, in passing, that other active devices such as CMUT's could be used to build such a geometry in regards to the transducer arrangement (Friemel, et al., column 7, lines 23-25), but there is no teaching of using CMUT's with a backing block. Traditionally, backing blocks are not used with CMUT's or MUT's, and the cited references do not suggest otherwise. Both references fail to teach the same recited limitation, so claim 21 is allowable. Also, there is no motivation or suggestion to combine the cited references to provide the recited claim. Backing is taught for

PZT transducers, and not taught for CMUT's. Therefore, the prima facie case of obviousness has not been met and claim 21 is allowable. Claims 22-23 depend from allowable claim 21 and, therefore, are allowable for at least this reason.

Claims 2 and 26 recite capacitive membranes in conjunction with a backing block. These claims are allowable for at least the same reasons given for allowable claim 21.

Claim 4 was rejected pursuant to 35 U.S.C. § 103(a) as being unpatentable over Bar-Cohen in view of Hazony, et al. (U.S. Patent No. 5,612,930).

The Examiner argues that the anechoic surface comprising a Rayleigh dump feature of claim 4 is taught by combining Bar-Cohen and Hazony, et al. (Office Action, page 4). However, there is no suggestion or motivation to combine the references. First, Hazony, et al. discloses a retaining member 16 that receives a fastening screw 58, where the retaining member 16, which grippingly engages the inner surface of the housing 12, applies a compressive force to the piezoelectric element 18 via a backing member 20. (Hazony, et al., Figure 1 and column 3, lines 20-27). This is a complete different physical arrangement and structure compared to the device of Bar-Cohen (see Figures 1 and 4). The device of Bar-Cohen would have to be physically altered beyond its original purpose to use the backing member 20 of Hazony, et al. Second, Hazony, et al. teaches that the backing member 20 is formed from a metallic material, such as brass. (Hazony, et al., column 4, lines 29-30). However, Bar-Cohen teaches backing layers using specific combination of materials to the degree that claim 1 of Bar-Cohen recites the material of the backing layers with "consisting of" language, and brass is not part of the claim language or the disclosure for that matter. Also, the Background section of Bar-Cohen discloses a tungsten, copper, and indium-lead alloy used for a backing layer but explains that this combination has a relatively low attenuation. (Bar-Cohen, column 1, lines 32-44). Therefore, the Detailed Description of Bar-Cohen introduces a second backing layer composed of a tungsten, copper, indium 50-lead 50, and diallyl-phthalate alloy having high attenuation properties. (Bar-Cohen, column 2, lines 22-24). Using brass of Hazony, et al. would change the element composition of the backing layers of

Bar-Cohen and may alter the original purpose of the desired matching and high attenuation. (Bar-Cohen, column 1, lines 47-51). Accordingly, there is no motivation to use the backing member 20 of Hazony, et al. with the invention of Bar-Cohen. Therefore, the prima facie case of obviousness has not been met and claim 4 is allowable for at least this reason.

Claim 9 was rejected pursuant to 35 U.S.C. § 103(a) as being unpatentable over Bar-Cohen in view of Frey (U.S. Patent No. 5,711,058).

The Examiner argues that it would have been obvious to use aluminum in backing layers by combining the teachings of Bar-Cohen and Frey. (Office Action, page 4). However, there is no suggestion or motivation to combine the references. Bar-Cohen teaches backing layers using specific combination of materials to the degree that claim 1 of Bar-Cohen recites the material of the backing layers with "consisting of" language, and aluminum is not part of the claim language or the disclosure for that matter. Also, the Background section of Bar-Cohen discloses a tungsten, copper, and indium-lead alloy used for a backing layer but explains that this combination has a relatively low attenuation. (Bar-Cohen, column 1, lines 32-44). Therefore, the Detailed Description of Bar-Cohen introduces a second backing layer composed of a tungsten, copper, indium 50-lead 50, and diallyl-phthalate alloy having high attenuation properties. (Bar-Cohen, column 2, lines 22-24). Using aluminum of Frey would change the element composition of the backing layers of Bar-Cohen and may alter the original purpose of the desired matching and high attenuation. (Bar-Cohen, column 1, lines 47-51). Accordingly, there is no motivation to use the backing core 46 of Frey with the invention of Bar-Cohen. Therefore, the prima facie case of obviousness has not been met and claim 9 is allowable for at least this reason.

Claims 10-11 and 13-16 were rejected pursuant to 35 U.S.C. § 103(a) as being unpatentable over Bar-Cohen in view of Miller, et al.

Independent claim 10 recites, *inter alia*, "the first material having substantially no acoustic attenuation at a range of frequencies for operation of the array of

elements.” The Examiner argues that all the features of claim 10 are taught by the combination of the cited references. (Office Action, page 5). However, neither reference teaches a material adjacent to the transducer material having substantially no acoustic attenuation at a range of frequencies for operation of the array of elements. Column 7, lines 66-68 of Miller, et al. discloses that the upper layer 37a should have sufficient acoustic attenuation. In the Background section of Bar-Cohen, there is mention of a backing layer that has a relatively low attenuation (column 1, lines 44-46), but relatively low is not the same as substantially no acoustic attenuation.

Furthermore, there is no motivation to combine the references. The backing layer 37b of Miller, et al. is formed of a material designed specifically to attenuate the acoustic energy in the wires 39, and Bar-Cohen teaches backing layers using a specific combination of materials. Also, Figure 1 and claim 4 of Bar-Cohen disclose a surface interface between the backing layers that is tilted to induce wave scattering, preventing return reflections. However, if such a backing would be used with an array of elements, the wave scattering would be directed to adjacent elements in the array causing undesirable disturbance. Accordingly, there is no suggestion or motivation to use the backing layers of Bar-Cohen with the invention of Miller, et al. Therefore, the prima facie case of obviousness has not been met and claim 10 is allowable. Claims 11 and 13-16 depend, directly or indirectly, from allowable claim 10 and, therefore, are allowable for at least this reason.

Further limitations distinguish from the cited references, resulting in these claims being allowable. Claim 13 recites, *inter alia*, a Rayleigh dump surface. Figure 1 and claim 3 of Bar Cohen disclose a roughened surface to induce wave scattering, but there is no specific teaching of a Rayleigh dump. Claim 15 recites, *inter alia*, that “the first material has a thermal conductivity greater than the transducer material,” and neither reference teaches this feature. Claim 16 recites, *inter alia*, that the transducer material comprises silicon, and neither reference teaches this feature.

Claims 12 and 17-20 were rejected pursuant to 35 U.S.C. § 103(a) as being unpatentable over Bar-Cohen in view of Miller, et al. and further in view of Frey.

Independent claim 17 recites, *inter alia*, "a backing block on at least one side of the transducer material, the backing block including a solid block of first material adjacent to the transducer material, the first material having a thermal conductivity greater than the transducer material." The Examiner argues that all the features of claim 17 are taught by the combination of the cited references. (Office Action, page 5). As mentioned above, there is no motivation or suggestion to combine Bar-Cohen and Miller, et al. Also, the combination of the cited references do not teach the features. Figure 5B and column 5, lines 57-65 of Frey disclose a backing layer 36 that is adjacent to the piezoelectric ceramic layer 40 and a backing core 46 that may be made of a material, such as aluminum alloy, having a high thermal conductivity. However, the backing core 46 of Frey is not adjacent to the ceramic layer 40, so there is no suggestion of the material with the greater conductivity adjacent to the transducer material.

Also, there is no suggestion or motivation to combine Bar-Cohen with Frey. Bar-Cohen teaches backing layers using specific combination of materials to the degree that claim 1 of Bar-Cohen recites the material of the backing layers with "consisting of" language, and aluminum is not part of the claim language or the disclosure for that matter. Accordingly, there is no motivation to use the backing core 46 of Frey with the invention of Bar-Cohen.

Furthermore, there is no suggestion or motivation to combine Miller, et al. with Frey. Miller, et al. uses backing layers to attenuate acoustic energy coupled into wires 39. (Miller, et al., column 7, lines 61-64 and column 8, lines 3-7). The backing core 46 of Frey would have to be physically altered beyond its original purpose to use the teachings of Miller, et al. Aluminum alloy is not castable, and, therefore, the wires 39 of Miller, et al. may not be able to be combined with the backing core 46 of Frey. Also, the material of the backing layers of Miller, et al. are designed to attenuate acoustic energy from the transducer and the wires 39, respectively. (Miller, et al., column 7, lines 59-68 and column 8, lines 1-13). Using an aluminum alloy backing core 46 to replace

either layer 37a or 37b of Miller, et al. would defeat that purpose. Therefore, the prima facie case of obviousness has not been met and claim 17 is allowable. Claims 18-20 depend from allowable claim 17 and, therefore, are allowable for at least this reason.

Further limitations distinguish from the cited references, resulting in these claims being allowable. Claim 19 recites a Rayleigh dump surface. Figure 1 and claim 3 of Bar Cohen disclose a roughened surface to induce wave scattering, but there is no specific teaching of a Rayleigh dump.

Claim 12 recites, *inter alia*, a first material that comprises aluminum. Claim 12 is allowable for at least the same reasons given for allowable claim 17.

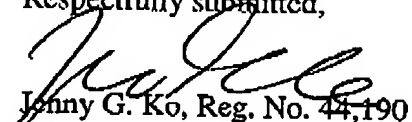
CONCLUSION

Applicant respectfully submits that all of the pending claims are in condition for allowance and seeks early allowance thereof. If for any reason, the Examiner is unable to allow the application but believes that an interview would be helpful to resolve any issues, he is respectfully requested to call the undersigned at (650) 694-5810 or Craig Summerfield at (312) 321-4726.

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